framatome

Neutron activation calculations

Computer code for the generation of neutron activation for LWR, SMR, CANDU, FBR, MTR, fusion

Framatome's state-of-the-art computer code for the generation of neutron activation with the highest degree of flexibility, integrity, precision and computational efficiency by using continuous-energy nuclear data and cutting-edge algorithms.

Challenge

The exposure of materials in nuclear reactors to intense neutron radiation leads to the formation of radioactive activation products.

To ensure safety and regulatory compliance, it is essential to accurately quantify the nuclide-specific activities of activation products during both operational and decommissioning phases. Such information is also crucial for the generation of radioisotopes intended for medical applications.

Currently, there are no general-purpose, continuous-energy neutron activation codes available that can perform neutron activation calculations for arbitrary neutron flux spectra.

Solution

Framatome has developed a Computer Code for the Generation of Neutron Activation (COGNAC), that calculates activities, decay power, gamma spectra, and unshielded gamma dose rates.

COGNAC fully leverages activation, decay, fission yield, and gamma spectrum data from leading nuclear data libraries, including TENDL-2017/-2021/-2025, JEFF-3.3, and JENDL-5.

The code utilizes continuous-energy cross-section data and accommodates neutron flux spectra on arbitrarily fine energy grids, ensuring maximum precision and applicability across all types of fission and fusion reactors.

For highest computational efficiency and accuracy, COGNAC utilizes most advanced matrix exponential solvers: ACME and CRAM up to order 48.

Customer benefits

More reliable safety assessments, design, and operations cost planning

Complete quantification of activation products and their related dose impacts

Compliance with safety standards, reducing risk of regulatory penalties and related costs



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Technical Information

- **Most Up-to-Date Nuclear Data Libraries:** TENDL 2025 / JEFF 3.3 / JENDL-5
- **Completeness:** Full consideration of all activation-decay chains
- **Maximum Precision:** Processing of continuous energy cross section data and neutron flux spectra on arbitrarily fine energy grids
- **Computational Efficiency and Accuracy:** Utilization of most advanced matrix exponential solvers

Key figures

> 2000 nuclides

256 reaction types

+ 250,000 reactions.

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